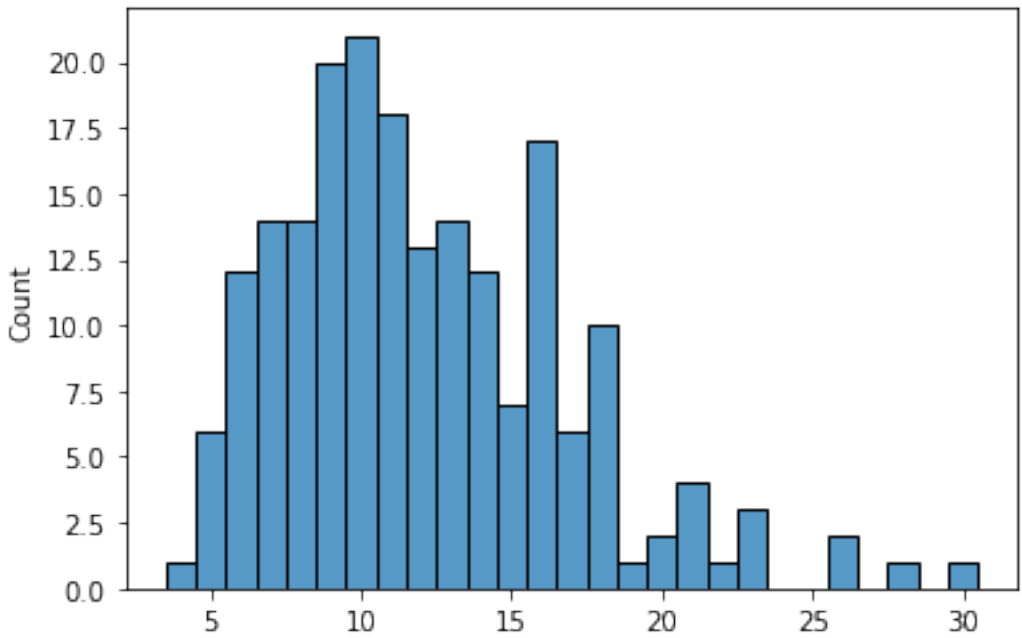


```
In [1]: import numpy as np
import pandas as pd
import seaborn as sns
import math
import random
import matplotlib.pyplot as plt
```

```
In [2]: def polymers(simulations,N):
max_radii = np.zeros(simulations)
for i in np.arange(simulations):
    x_0=0
    r=0
    for j in np.arange(N):
        v=random.uniform(0,1)
        if v<1/2:
            x_0+=1
        else:
            x_0-=1
        r=max([r,abs(x_0)])
    max_radii[i]=r
sns.histplot(data=max_radii,discrete=True)
plt.savefig("100 polymers")
```

```
In [3]: polymers(200,100)
```



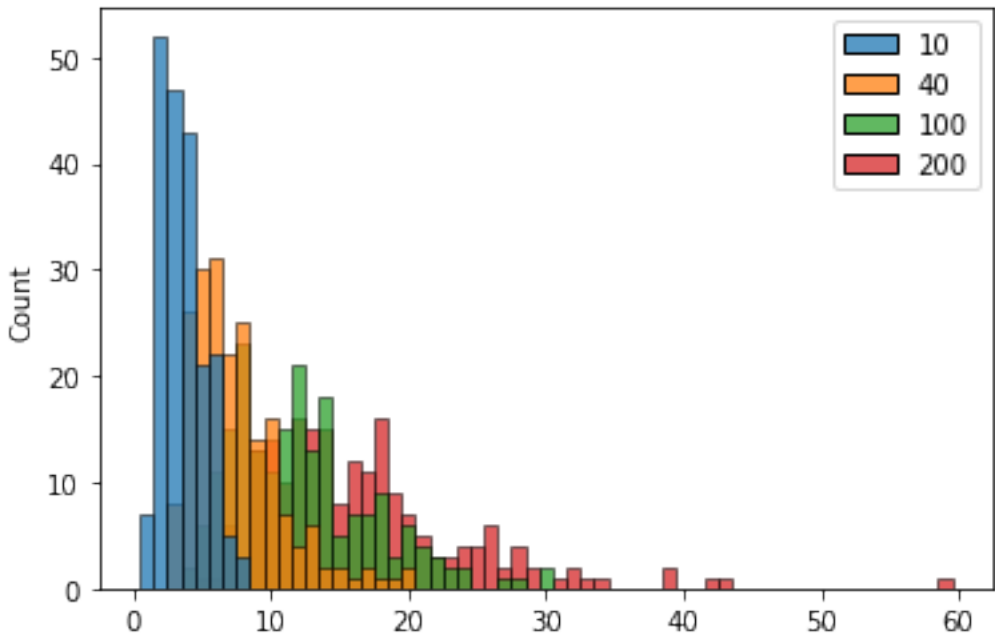
```
In [4]: def polymers_2(simulations,N_1,N_2,N_3,N_4):
max_radii = pd.DataFrame({str(N_1):[],
                           str(N_2):[],
                           str(N_3):[],
                           str(N_4):[]})

for i in np.arange(simulations):
    x_1=0
    r_1=0
    for j_1 in np.arange(N_1):
        v=random.uniform(0,1)
        if v<1/2:
            x_1+=1
        else:
            x_1-=1
        r_1=max([r_1,abs(x_1)])
    x_2=0
    r_2=0
    for j_2 in np.arange(N_2):
        v=random.uniform(0,1)
        if v<1/2:
            x_2+=1
        else:
            x_2-=1
        r_2=max([r_2,abs(x_2)])
    x_3=0
    r_3=0
    for j_3 in np.arange(N_3):
        v=random.uniform(0,1)
        if v<1/2:
            x_3+=1
        else:
            x_3-=1
        r_3=max([r_3,abs(x_3)])
    x_4=0
    r_4=0
    for j_4 in np.arange(N_4):
        v=random.uniform(0,1)
        if v<1/2:
            x_4+=1
        else:
            x_4-=1
        r_4=max([r_4,abs(x_4)])
    max_radii=max_radii.append(
        {str(N_1):r_1,
         str(N_2):r_2,
         str(N_3):r_3,
         str(N_4):r_4},ignore_index=True)

sns.histplot(data=max_radii,discrete=True)
plt.savefig("10-200 polymers")
return np.array([np.mean(max_radii[str(N_1)]),np.mean(max_radii[str(N_2)]),np.mean(max_radii[str(N_3)]),np.mean(max_radii[str(N_4)])])
```

```
In [5]: poly=polymers_2(200,10,40,100,200)
poly**2
```

```
Out[5]: array([ 12.96      ,  55.6516   , 151.5361   , 278.723025])
```



```
In [ ]:
```